[1], we should expect $\gamma = 1$ for both $Fe^{54} - Fe^{56}$ and $Fe^{56} - Fe^{58}$. We see that this is in poor agreement with the experimentally obtained values. This may be due to the fact that the $1f_{7/2}$ proton subshell of the iron isotopes, unlike that of the nickel isotopes, is not filled. Experiments with μ-mesic atoms [5] yielded $\gamma = 0.94 \pm 0.05$ for $Fe^{54} - Fe^{56}$. This value differs from that obtained by us, but also indicates a strong change of the radius.

On going from the nuclei $Fe^{56, 58}$ to Ni^{58}, the increments of the mean-square radii turn out to be negative. This decrease of the mean-square radius is apparently due to the fact that the state $1f_{7/2}$ is completely filled in the Ni^{58} nucleus, which becomes more compact.

It is of interest to compare our data with the results of measurements of the relative radii of the interaction of protons with the isotopes of Fe and Ni [6], which turned out to be 13.7 ± 0.7, 15.5 ± 0.6, 15.8 ± 0.6, 15.1 ± 0.6, and 17.6 ± 0.9 F for Fe^{54}, Fe^{56}, Fe^{58}, Ni^{58}, and Ni^{62}, respectively. We see that the behavior of the changes of the charge radii and of the interaction radii is qualitatively the same for these nuclei. It is interesting that the interaction radius for Ni^{58}, like the charge radius, is smaller than for Fe^{56} and Fe^{58}, thus indicating that filling of the proton shell exerts an influence on the mass radius of the nucleus.

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RESONANT CHARACTER OF THE CHANGE OF THE SURFACE SELF-DIFFUSION ENERGY OF TUNGSTEN IN STRONG ELECTRIC FIELDS

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According to the present notions, the influence of an external electric field on the diffusion of atoms in their own lattice reduces to a lowering of the surface-diffusion energy as a result of the interaction of the induced dipoles with the external field. According to Drechsler, the decrease of the energy is given by

$$\Delta Q_M = \alpha F^2/2 \quad , \qquad (1)$$

where α is the polarizability of the atoms on the surface and F is the applied field. The expected change in the energy of diffusion of tungsten over tungsten, in observable fields (-3×10^7 to 3×10^7 V/cm), at a polarizability $\alpha = 7 \times 10^{-24}$ cm^3 [1], amounts to $\Delta Q_M = 0.044$ eV.

Fig. 1

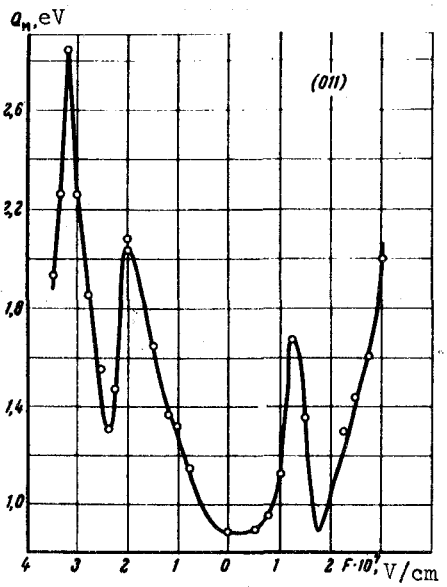
We have attempted to verify Drechsler's hypothesis by measuring directly the energy of surface diffusion of tungsten in the vicitity of the (011) and (001) faces of tungsten in fields of different polarities.

The measurements were made with a field-emission electron microscope. Tungsten was sputtered on a tungsten emitter consisting of an electrically heated tungsten coil. After sputtering, bright "collars" are produced around the close-packed weakly-emitting faces (100), (110), and (121), indicating that three-dimensional formations are produced with enhanced local field intensity (Fig. 1). When the tip is heated to temperatures at which evaporation of the condensate is excluded without any doubt, one can observe a gradual vanishing of the "collars" via diffusion of the tungsten atoms over their own lattice [2]. By measuring the time of vanishing of the "collars" at different temperatures, it is possible to use the Arrhenius formula

$$t = A\exp(Q_M / kT)$$

(A is a constant independent of Q_M) to determine the surface-diffusion energy Q_M.

The use of a pulsed procedure has made it possible to carry out the measurements both in the presence of an electrostatic field of either polarity and in its absence. Usually, rectangular pulses of 4 - 5 μsec duration were applied with a repetition frequency ∿400 Hz. As shown earlier in [3], such short pulses do not influence the process of surface diffusion. The vanishing of the "collars" following the heating of the point was revealed by the decrease of the current of a photomultiplier placed on the chosen face. The migration time was determined as the time of decrease between two values of the photomultiplier current following almost complete vanishing of the "collars," i.e., it was assumed not to differ strongly from the current for a cleaned smoothly-rounded surface. This has made it possible to assume that the field intensity at the instant of measurement does not differ from the field for a smooth surface of the point, which was calculated from the Fowler-Nordheim lines prior to each measurement of Q_M.



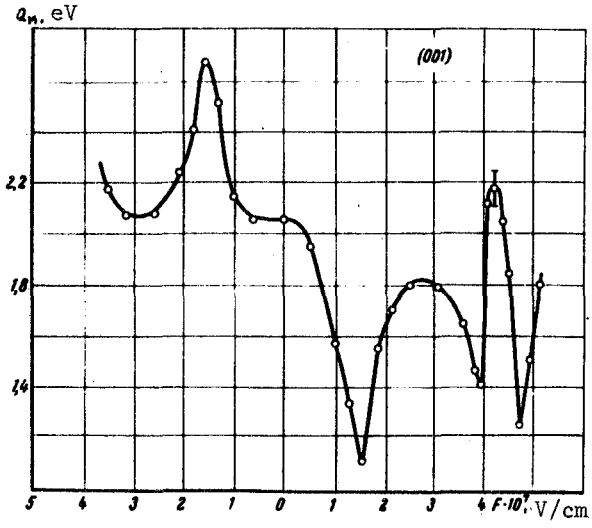


Fig. 3

The values of the energy Q_M were measured for migration in the vicinities of the faces (110) and (100) in the entire possible interval of positive and negative fields (i.e., with the point positive and negative).

Figures 2 and 3 show the results of measurements of $Q_M(F)$. The curves obviously do not agree with formula (1). The presence of clearly pronounced maxima and minima indicates a more complicated character of the action of the external electric field on the surface atoms of the tungsten. The values of Q_M lie in the ranges (0.5 - 2.3) ± 0.05 eV for the (011) face and (1.1 - 2.7) ± 0.05 eV for the (001) face. The interval of variation of $Q_M(F)$ greatly exceeds the measurement error.

The asymmetry of $Q_M(F)$ relative to the point F = 0, especially for the (001) face, points to the presence of a term $p_{eff}F$, where p_{eff} is the effective dipole moment of the atom adsorbed on its own lattice. The greatly different behavior of $Q_M(F)$ on the faces (001) and (011) indicates that p_{eff} (and also α_{eff}) depends strongly on the surface structure.

It is impossible at present to offer a definite interpretation of the observed effect.

As a working hypothesis, we can suggest the following explanation: In a field $F \sim 10^7$ V/cm (i.e., lower by one order of magnitude than the lattice field and higher by two orders than the fields causing splitting of the levels of the free atoms), intersection and mixing of the levels of the surface atoms occurs and leads to a dipole-moment variation that is resonant in the field, and hence to a change in the migration energy Q_M.

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ACOUSTO-ELECTRONIC INTERACTION IN CdS FOR PURE SHEAR SURFACE WAVES

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It was shown in recent papers [1, 2] that in crystals of class C_{6v} there can propagate piezoactive waves of a new type, namely pure shear surface waves (SSW), wherein the particles are displaced only along the propagation surface. There are no published reports of investigations of interactions between the SSW and electrons. We have investigated electron absorption and amplification of SSW, and also the acousto-electric (AE) effect in CdS single crystals on surface waves.

The experimental setup is shown in Fig. 1a. Two systems of electrodes are placed on two etched side surfaces of a photosensitive CdS crystal with length perpendicular to the C_6 axis - one on the $\{10\bar{1}0\}$ plane for the excitation and reception of the SSW, and one on the {0001} plane for the Rayleigh